

AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions, and listings, of claims the application.

LISTING OF CLAIMS

Claim 1. (original) A fluidic logic device comprising: an elastomeric block; and a plurality of microfabricated channels formed in the elastomeric block, each channel containing a pressure or flow representing a signal, a change in the pressure or flow in a first channel resulting in a change in the pressure or fluid flow in a second channel consistent with a logic operation.

Claim 2. (original) The device of claim 1, where the change in pressure or flow in the second channel is nonlinear with respect to the pressure or fluid flow changes in the first channel.

Claim 3. (original) The device of claim 1 wherein a one way valve is positioned in at least one of the first channel and the second channel.

Claim 4. (original) The device of claim 3 wherein: the second channel comprises an inlet in communication with an outlet through a flow restrictor, the second channel including a junction upstream of the flow restrictor; and the first channel comprises at least two control channels connected at the junction through one-way valves, such that pressures of the control channels are reflected at the outlet consistent with an AND-type truth table.

Claim 5. (original) The device of claim 1 wherein: the second channel comprises an inlet portion and an outlet portion; and the first channel comprises at least two control

channels adjacent to the first channel and separated from the first channel by respective first and second elastomer membranes, such that application of pressures to the control channels deflects at least one of the first and second membranes into the flow channel to reflect a pressure at the outlet consistent with a NOR-type truth table.

Claim 6. (original) The device of claim 1 wherein: the second channel comprises first and second inlet portions that merge to form an outlet portion; and the first channel comprises first and second control channels adjacent to the first and second inlet portions, the first control channel separated from the first and second inlet portions by respective first and second membranes, and the second control channel separated from the first and second portions by respective third and fourth membranes, such that application of control pressures to the first and second control channels deflects at least one of the first, second, third, and fourth membranes into the first and second inlet portions to reflect a pressure at the outlet consistent with a NOR-type truth table.

Claim 7. (original) The device of claim 6 further comprising an amplification structure positioned between the first channel and at least one of the first, second, third, and fourth membranes.

Claim 8. (original) The device of claim 1 wherein an outlet of the second channel is in fluid communication with a first channel of a second fluidic logic device.

Claim 9. (original) A pressure amplifier comprising: an elastomeric block formed with first and second microfabricated recesses therein; and an amplifier structure having a first surface area in contact with the first recess and a second surface area in contact with the second recess, the first surface area larger than the second surface area such that a pressure in the first recess is communicated by the amplifier structure as an amplified pressure to the second recess.

Claim 10. (original) The pressure amplifier of claim 9 wherein the first recess comprises a control channel.

Claim 11. (original) The pressure amplifier of claim 9 wherein the second recess comprises a flow channel.

Claim 12. (original) The pressure amplifier of claim 9 wherein the amplifier structure is a rectangular pyramid.

Claim 13. (original) The pressure amplifier of claim 9 wherein the amplifier structure is a cone.

Claim 14. (original) A method of amplifying a pressure in a flow channel of a microfabricated elastomer structure, the method comprising: providing an elastomer block including a first recess in contact with a first area of an amplifier structure and second recesses in contact with a second area of the amplifier structure; applying a pressure to the first area; and communicating the pressure to the second area, the second area smaller than the first area such that the pressure communicated to the second recess is amplified.

Claim 15. (original) The method of claim 14 wherein the first recess is a control channel and the pressure is applied by pressurization of the control channel.

Claim 16. (original) The method of claim 14 wherein the second recess is a flow channel and the amplified pressure is employed to control a flow of fluid through the flow channel.

Claim 17. (original) A one-way valve comprising a microfabricated channel formed in an elastomeric block, a flap integral with the elastomeric block projecting into the channel

and blocking the channel, the flap deflectable to permit fluid to flow in only a first direction.

Claim 18. (original) The one-way valve of claim 17 wherein the flap is integral with a ceiling portion of the channel.

Claim 19. (original) The one-way valve of claim 14 wherein the flap is prevented from moving in a second direction opposite the first direction by a protuberance on a wall of the channel.

Claim 20. (original) The one-way valve of claim 19 wherein the protuberance affords a portion of the channel a narrower cross section than the flap.

Claim 21. (original) A method of filling a microfabricated elastomeric structure with fluid comprising: providing an elastomer block having a flow channel, the elastomer block comprising an elastomer material known to be permeable to a gas; filling the flow channel with the gas; injecting a fluid under pressure into the flow channel; and permitting gas remaining in the flow channel to diffuse out of the elastomer material.

Claim 22. (original) The method of claim 21 wherein the elastomer is a silicone elastomer and the gas is air.

Claim 23. (original) A method of metering a volume of fluid comprising: providing a chamber having a volume in an elastomeric block separated from a control recess by an elastomeric membrane; supplying a pressure to the control recess such that the membrane is deflected into the chamber and the volume is reduced by a calibrated amount, thereby excluding from the chamber the calibrated volume of fluid.

Claim 24. (original) The method of claim 23 wherein the calibrated volume of fluid is provided to a further microfluidic system.

Claim 25. (original) The method of claim 23 further comprising: providing a second fluid to an opening of the chamber; and ceasing application of the pressure such that the membrane relaxes back to an original position and the calibrated volume of the second fluid is drawn into the chamber.

Claims 26-31. (canceled)

Claim 32. (original) A method of promoting adhesion between layers of a microfabricated structure, the method comprising: exposing a surface of a first component layer to a chemical; exposing a surface of a second component layer to the chemical; and placing the surface of the first component layer into contact with the surface of the second elastomer layer.

Claim 33. (original) The method of claim 32 wherein the first and second component layers comprise silicone elastomers and the chemical comprises ethanol.

Claim 34. (original) The method of claim 33 wherein the component layers are dried before being placed into contact.

Claim 35. (original) The method of claim 32 wherein the first component layer comprises an elastomer and the second component layer comprises a glass substrate, the first and second component layers exposed to ethanol and dried before being placed into contact.

Claim 36. (original) A method for actuating a microfabricated elastomer structure comprising: providing an aqueous salt solution in a control recess formed in an elastomeric block and overlying and separated from a flow channel by an elastomer membrane; and applying a potential difference to the salt solution to generate a gas, such that a pressure in the control recess causes the membrane to deflect into the flow channel.

Claim 37. (original) The method of claim 36 wherein the gas diffuses out of the elastomeric block to permit the membrane to relax out of the flow channel.

Claim 38. (original) The method of claim 36 wherein the gas is mechanically vented to permit the membrane to relax out of the flow channel.

Claim 39. (original) A microfabricated syringe structure comprising: a first chamber formed in an elastomeric block and including an aqueous salt solution, a first electrode, and a second electrode; a second chamber formed in the elastomeric block and containing an inert liquid, the second chamber in fluid communication with the first chamber through a first flow channel; a third chamber formed in the elastomeric block and containing an ejectable material, the third chamber in fluid communication with the second chamber through a second flow channel and in fluid communication with an environment through an outlet, such that application of a potential difference across the electrodes generates gas in the first chamber, the gas displacing the inert material into the third chamber, the inert material displacing the injectable material into the environment.

Claim 40. (original) A method of fabricating an elastomeric structure comprising: cutting the first elastomer structure along a vertical section to form a first elastomer portion and a second elastomer portion; and bonding the first elastomer structure to another component.

Claim 41. (original) The method of claim 40 wherein the first elastomer layer is of a first type and the second elastomer layer is of a second type complementary to the first type, the method further comprising: forming a second elastomer structure; cutting the second elastomer structure along a vertical section to form a third elastomer portion and a fourth elastomer portion; and bonding the first elastomer portion to the third elastomer portion to form a third elastomer structure.

Claim 42. (original) The method of claim 41 wherein the third elastomer portion is of the second type and the fourth elastomer portion is of the first type.

Appl. No. 09/826,583
Amdt. dated Feb 8, 2004
Reply to Office action of Aug 8, 2003

Claim 43. (original) The method of claim 40 wherein the other component is a membrane, and further comprising bonding a second elastomer structure to an opposite side of the membrane than the first elastomer structure is bonded to.
